



Florida Integrated Science Centers

Amphibian Research and Monitoring Initiative (ARMI); Inventory and Monitoring in the Southeast Region (2002).

Annual Report

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Introduction

ARMI research in the Southeastern Region is conducted from the Center for Aquatic Resources of the Florida Integrated Science Centers, Gainesville, Florida. Additional ARMI-related research has been conducted by USGS biologists with the Miami-based Center for Water and Restoration Studies, although they have not received ARMI funding. SEARMI is responsible for monitoring the status of amphibians in NC, SC, GA, FL, AL, TN, PR, and VI, an area approximately 800 x 1000 linear miles, excluding the Caribbean territories. Within this area, Department of Interior (DOI) land holdings are numerous, ranging in size from “postage stamp” historical sites to extremely large ecosystem-wide parks and preserves. Most lands are administered by the National Park Service and the U.S. Fish and Wildlife Service; the Bureau of Land Management has certain responsibilities for oversight in coal mining areas (such as in northern Alabama), but there are no land holdings.

As in other areas, SEARMI monitors amphibians based on a 3-tiered approach involving sites with intensive research (apex sites), sites that form the basic areas for the core of monitoring activities (mid-level sites), and sites where inventories are conducted (base sites). With few exceptions, federal lands in the southeast have not been surveyed for amphibians or their habitats, thus requiring inventories before proceeding to more intensive study. For this reason, most current research focuses on mid-level and base sites. Another emphasis has been on the development of appropriate sampling techniques and in understanding the biases associated with their use. Information from SEARMI’s inventory and monitoring program (data collected from the mid-level and apex sampling sites) will be used to assess the status of amphibians on Department of Interior lands using PAO analyses (that is, the proportion of area occupied by various species). By making probabilistic arguments, PAO uses an estimation of site occupancy rate to measure species detection probabilities. More information on PAO appears in the scientific literature. SEARMI biologists are collecting extensive data on species and their habitats that will allow for an assessment of distribution patterns and trends, and the initiation of research on declines or problem areas should they be identified. Finally, we are developing partnerships and collecting data on amphibian distribution, available literature, and the extent of previous amphibian surveys on DOI lands.

- Extensive Broad Scale Sampling (Base Sites)
 - Great Smoky Mountains National Park; GSMNP (1998-2001)
 - Okefenokee National Wildlife Refuge; ONWR (2000-2002)
 - St. Marks National Wildlife Refuge; SMNWR (2002)
 - Lower Suwannee National Wildlife Refuge; LSNWR (2002)
 - Big Cypress National Preserve (2001-2002)
 - Everglades National Park (2001-2002)
- Core of SEARMI Sampling (Mid-level Monitoring Areas)
 - Terrestrial salamanders (GSMNP, 1998-2000)
 - Cave salamanders (GSMNP, 1998-2001)
 - Aquatic and terrestrial amphibians (ONWR, 2000-2002)

- Intensive (Apex Sites)
 - SMNWR (Mark/recapture study of amphibians at terrestrial sites. Comparison with USFWS data from late 1970's)
 - ONWR (Mark/recapture study of hyliid frogs and aquatic salamanders)

Current results

Great Smoky Mountains National Park (GSMNP). – Field work in the GSMNP was conducted from 1998-2001. Details of this work have been presented elsewhere (see reports and www.fcsc.usgs.gov). In FY 2002, these data were extensively subjected to QA/QC, summary, analysis, and interpretation. Based on these efforts, a book, a research manual, several peer-reviewed papers and notes, and presentations at professional society meetings were written and accepted for publication (see Products). A preliminary model has been developed simulating salamander life functions. This whole model can be embedded in a single pixel of a raster coverage of the Great Smokey Mountain NP, serving as the vehicle by which we will explore how external influences affect salamander communities using GIS layers.

Okefenokee National Wildlife Refuge (ONWR). – Field research in ONWR extended from August 2000 until August 2002. Most PVC and coverboards have now been removed from the refuge; sampling equipment remains in place in certain inaccessible (because of low water levels) areas. We used a wide variety of sampling techniques to inventory species, and 16 intensive sites were monitored using PVC pipe, coverboards, traps, automated call data loggers (ACDL), and visual encounter surveys. Inventory surveys (extensive sites) consisted of visiting 5-10 sites per month for 1-3 days per sampling period; sites were stratified in 7 habitat types. A total of 185 sites were sampled (35 3-day surveys; 80 1-day surveys). Fifteen frogs and 4 salamanders (N=2677 individuals) were recorded, including the rare *R. capito* and *R. virgatipes* (recorded only using ACDLs). The number of species detected varied by sampling technique; for example, 11 of 15 frogs were detected using frogloggers. Call phenology varied by species, with some species being detected only during narrow windows of time. From 6 to 16 species were found in the various habitat types. Species preferences also varied by habitat type, with species found in from 2 to 7 (of 7 possible) different habitat types. Using similar sampling techniques, the 16 intensive sites were visited 3 times per season in each of 4 seasons. We used program PRESENCE to estimate capture probabilities and calculated PAO for 3 species: *Rana grylio*, *R. virgatipes*, and *Hyla femoralis*. Capture probability varied widely depending on season, as did PAO for *R. grylio*. Work on the refuge has been suspended as of August 2002 because low water levels and a difficulty in gaining access to sampling sites.

St. Marks National Wildlife Refuge (SMNWR). – Located in the Florida panhandle, SMNWR has a diversity of upland and wetland habitats and potentially supports 40 species of amphibians (21 anurans and 19 caudates). SEARMI established the refuge primarily as a mid-level monitoring area in the summer of 2002, but we are also conducting base and apex level activities. We are using a diversity of methods to conduct an inventory of amphibians (and reptiles) on the refuge and are collecting data to estimate species detectability at apex and base-level sites that we will use to design a long-term monitoring plan incorporating PAO. We established drift-fence arrays (with associated pitfall and funnel traps) at 12 apex sites to repeat a study conducted by the USFWS in the late 1970's. We plan to compare current species richness

and abundance to that revealed by the USFWS study two decades ago. We plan to reanalyze their data and use the “open” model in program PRESENCE to compare their historic findings with what we find during the next year. During our first 2 sampling periods at SMNWR, which were only 4 nights each, we captured 304 individuals of 11 species, including 2 federally listed *Ambystoma cingulatum* (Flatwoods Salamander). We documented *Eleutherodactylus planirostris* (Greenhouse frog) on the refuge, which was not present 20 years ago. We have also conducted visual encounter surveys and aquatic sampling in numerous ponds on the refuge. Thus far we have found 24 species of amphibians (19 anurans and 5 caudates). We deployed environmental monitoring equipment at 3 of our apex sites and collaborated with Brian Hughes (USGS—WRD) to analyze water samples at 9 locations on the refuge.

Lower Suwannee Cedar Keys National Wildlife Refuge (LSNWR). – LSNWR is located on the Gulf Coast in Florida’s Big Bend and potentially supports 37 species of amphibians (21 anurans and 16 caudates). The refuge recently hired its first biologist and there are no historical data on amphibian species richness. SEARMI initiated field work (base-level inventory) on the refuge in the summer of 2002, and we plan to establish the refuge primarily as a mid-level monitoring area in late 2003. Because there are no historical amphibian data for the area, we are conducting broad-scale sampling (using a variety of methods) across the refuge to inventory species richness (including reptiles). Despite drought conditions that have persisted since we began work, we conducted upland and wetland sampling throughout the refuge in 2002 and confirmed the presence of 10 species of frogs and 1 salamander. Data we derive from this base-level work will be used to design a long-term monitoring plan.

Other activities. – We conducted an analysis of sampling biases (pipe location, pipe diameter, seasonal species preference) associated with occupancy of PVC pipes by hylid treefrogs. We sent frogs with malformations and suspected disease to the National Wildlife Health Center for screening.

Water Quality Monitoring. – We assisted Brian Hughes (WRD) in the collection and field processing of water samples from 4 sites in ONWR and 9 sites in SMNWR. Water-quality samples were collected at eight sites in the Okefenokee National Wildlife Refuge in the summer of 2002. Water samples were collected at eight stream, pond, and wetland sites in St. Marks National Wildlife Refuge in late summer after rains had increased water levels. Water levels were insufficient for sampling in Lower Suwannee River National Refuge due to the drought conditions this year. All sites sampled for water quality were co-located with amphibian monitoring sites. Field parameters (pH, conductance, dissolved oxygen, temperature), major ions, nutrients, trace metals (including mercury), and suspended/particulate organic carbon were analyzed at all the sites. Pesticide were analyzed in samples collected at St. Marks NWR only. Results of sampling at Okefenokee showed elevated levels of aluminum and iron in water samples, but concentrations were not above any aquatic criteria. The St. Marks NWR showed a wide variety of water-quality types, ranging from low pH, high carbon, low dissolved oxygen pond waters to moderate pH, low carbon, moderate dissolved oxygen streams and springs. Only six of the pesticide samples collected at St. Marks NWR have been analyzed and only one of the six samples had detectable pesticides. The sample collected at Shepard Spring had low concentrations of simazine, an agricultural herbicide, and deethylatrazine, a degradate of the herbicide atrazine.

Outreach. – The Schoolyard Treefrog Monitoring Project, introduced at the Florida Integrated Science Center Open House in April 2002, involves children in the study of amphibians and their habitats. Using artificial refugia (PVC pipes in the ground), the children can observe treefrogs found in the habitats around their schools. They report the species and number of individuals found to the project's website (http://www.fsc.usgs.gov/Education/Herpetology/Data_Submission/Submit_Form/submit_form.html), and can compare results with other schools. Seven schools in Gainesville, Tallahassee, and St. Petersburg, FL, Thomasville, GA, and Chapel Hill, NC, are currently participating.

Plans for 2003

- Continue year-round intensive sampling at SMNWR and LSNWR in order to develop data on species richness and distributional patterns. Certain long-term monitoring sites have been identified on SMNWR, and we will sample our drift-fence arrays for seven consecutive nights per month during 2003 (in collaboration with K. Enge of the Florida Fish and Wildlife Conservation Commission). This will allow us to estimate detection probabilities and design our PAO-based long-term monitoring program.
- At LSNWR, we will continue base-level inventory of the refuge, establish drift-fence arrays at numerous sites, choose sites for repeat sampling in order to estimate detection probabilities and thus design long-term monitoring plan incorporating PAO.
- We will work to extend SEARMI surveys to other DOI lands within the southeast, particularly in the coastal plain and piedmont regions. In this regard, we hope to partner with a USGS/WRD study of the effects of agricultural pollution on the Everglades ecosystem by establishing amphibian monitoring sites at 17 water quality sampling stations.
- Analysis of plot counts and PAO will be undertaken on survey data from GSMNP.
- Analysis of extensive and intensive data from ONWR.
- At all study sites, we will monitor for disease and malformations.
- In cooperation with USGS researchers and partners, we will collect animals and water samples in a national study of the effects of atrazine on amphibian populations.
- We plan to continue sampling at St. Marks NWR and to begin sampling at Lower Suwannee River NWR.

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Products

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